Claims

I claim:

1. A process for refinement of a motion estimate, comprising the steps of:

accepting input, wherein said input comprises:

a source image,

a target image,

a rectangular source block of pixels in the source image,

a best motion estimate of said block

from said source image to said target image,

a bounding box wherein said bounding box

contains said best motion estimate,

a best prediction error for said best motion estimate,

and

a depth bound to limit the precision of the refinement;

subdividing said bounding box to obtain a plurality of child bounding boxes,

with a child motion estimate for each of said child bounding boxes;

evaluating said child motion estimate for each of said child bounding boxes

to obtain a child prediction error for each of said child bounding boxes;

selecting from said evaluations of said child bounding boxes

a best child bounding box, a best child motion estimate,

and a best child prediction error;

optionally, according to whether said depth bound is greater than zero,

recursively refining said best child bounding box using

said source image,

said target image,

said source block,

said best child motion estimate,

said best child bounding box,

said best child prediction error,

and

said depth bound less one;

optionally, according to whether said best child prediction error is smaller

than said best prediction error,

resetting

said best prediction error

and

said best motion estimate

to

said best child prediction error

and

said best child motion estimate,

respectively;

and

providing output, wherein said output comprises

said best prediction error and said best motion estimate.

2. The process of Claim 1,

wherein said subdivision step uses a quadtree subdivision

providing four child bounding boxes.

3. The process of Claim 1,

wherein said child motion estimate for each of the said child bounding boxes

is the center of said child bounding box.

4. The process of Claim 1,

wherein said evaluation step for each of said child bounding boxes

is a process comprising the steps of:

texture mapping of a rectangular region in said target image,

said rectangular region of size equal to said source block,

and

said rectangular region displaced translationally

from the the position of said source block

according to said child motion estimate for said child bounding box,

wherein said texture mapping provides a prediction block

comprising a rectangular block of pixels

of equal size to said source block;

and

computation of said child prediction error using

a pixel-wise metric between said source block and said prediction block.

5. The process of Claim 4,

wherein said pixel-wise metric is the L^1 metric, that is,

the average of the absolute differences

between said source block and said prediction block

on a pixel by pixel basis.

6. The process of Claim 4,

wherein said pixel-wise metric is the L^2 metric, that is,

the square root of the average of the squared differences

between said source block and said prediction block
on a pixel by pixel basis.

7. The process of Claim 4,
wherein said pixel-wise metric is the L^∞ metric, that is,
the maximum of absolute differences
between said source block and said prediction block
on a pixel by pixel basis.

8. A process for refinement of an initial motion estimate
for a block of pixels between a source and a target image,
comprising the steps of:
generating a succession of trial motion estimates;
predicting said block of pixels for each of said trial motion estimates
by texture mapping from the target image
according to each trial motion estimate;
evaluating each of said predictions using a supplied pixel-by-pixel
metric to provide a measure of error;
and
selecting that trial motion estimate
from said succession of trial motion estimates
which minimizes said measure of error.

9. The process of claim 8, wherein
an initial bounding box is selected
such that the center of said initial bounding box
is said initial motion estimate;

and

said succession of trial motion estimates is obtained

by selection of the centers of bounding boxes obtained

by recursive quad-tree subdivision of the initial bounding box.

10. The process of claim 9, wherein said initial bounding box

is selected to have a dimensions of 1x1 pixels.

11. The process of claim 9, wherein

said quad-tree recursive subdivision of bounding boxes is restricted

to the particular bounding box at each recursive step

which minimizes said measure of error

obtained by said prediction and said evaluation

of the trial motion estimate associated with each successive bounding box.

12. The process of claim 8, wherein

the prediction step consists of texture mapping

a region of size equal to said block of pixels from said target image

where said region in said target image

is displaced from the position of said block of pixels in said source image

by translation according to said trial motion estimate.

13. The process of claim 8, wherein

said measure of error in said evaluation step

is the L^1 metric, that is,

the average of the absolute differences

between said source block and said prediction block

on a pixel by pixel basis.

14. The process of claim 8, wherein

said measure of error in said evaluation step

is the L^2 metric, that is,

the square root of the average of the squared differences

between said source block and said prediction block

on a pixel by pixel basis.

15. The process of claim 8, wherein

said measure of error in said evaluation step

is the L^∞ metric, that is,

the maximum of absolute differences

between said source block and said prediction block

on a pixel by pixel basis.